

73. An exposure apparatus for exposing a wafer to a pattern of a mask by using said optical system including said diffraction grating optical element according to Claim 71.

74. A device manufacturing method comprising:
a step of exposing a wafer to a device pattern of a mask by the exposure apparatus according to Claim 73; and
a step of developing the exposed wafer.

75. A diffractive optical element, which is used for an optical system of an exposure apparatus, said diffractive optical element comprising:
a light-shielding member composed of a material selected from the group consisting of TiC, TiN, ZrC, HfC and HfN, at a periphery of an effective area.

76. A diffractive optical element according to Claim 75, wherein said light-shielding member comprises an alignment mark.

77. An exposure apparatus for exposing a wafer to a pattern of a mask by using said optical system including said diffractive optical element according to Claim 75.

78. A device manufacturing method comprising:
a step of exposing a wafer to a device pattern of a mask by the exposure apparatus according to Claim 77; and
a step of developing the exposed wafer.

79. A diffractive optical element, which is used for an optical system of an exposure apparatus, said diffractive optical element comprising:
a light-shielding member composed of an acrylic or epoxy light-shielding ink at a periphery of an effective area, and an alignment mark used when arranging said light-shielding member into said optical system, wherein said light-shielding ink is not exposed to the outside.

80. An exposure apparatus for exposing a wafer to a pattern of a mask by using said optical system including said diffractive optical element according to Claim 79.

81. A device manufacturing method comprising:
a step of exposing a wafer to a device pattern of a mask by the exposure apparatus according to Claim 80; and
a step of developing the exposed wafer.

82. A diffractive optical element, which is used for an optical system of an exposure apparatus, said diffractive optical element comprising:

a light-shielding member composed of any one of (i) chromium, aluminum, molybdenum, tantalum and tungsten, (ii) a laminated structure of any one of chromium, aluminum, molybdenum, tantalum or tungsten and any one of chromium oxide, silicon oxide or aluminum oxide, (iii) a compound material of a metal and silicon, and (iv) a compound of any one of molybdenum or tungsten and silicon, silicon, or titanium oxide, at a periphery of an effective area.

83. A diffractive optical element according to Claim 82, wherein a wavelength of light used for the exposure is less than 250 nm.

84. An exposure apparatus for exposing a wafer to a pattern of a mask by said optical system including said diffractive optical element according to Claim 82.

85. A device manufacturing method comprising:
a step of exposing a wafer to a device pattern of a mask by the exposure apparatus according to Claim 84; and
a step of developing the exposed wafer. --